

OCEANS

Five great oceans cover 70% of our planet. They affect our history, and they are very important to our life today.

This book looks at the plants and animals that live in these oceans. It also points out the importance of protecting them, and how we should do this.

StandFor Graded Readers provide a range of engaging reading materials for learners of English. Carefully graded by level, the series includes retellings of great classics, and informative, factual titles.

▼ Level 1 | 380 Headwords

▼ Level 2 | 580 Headwords

▼ Level 3 | 800 Headwords

▼ Level 4 | 1000 Headwords



TEACHER'S BOOK

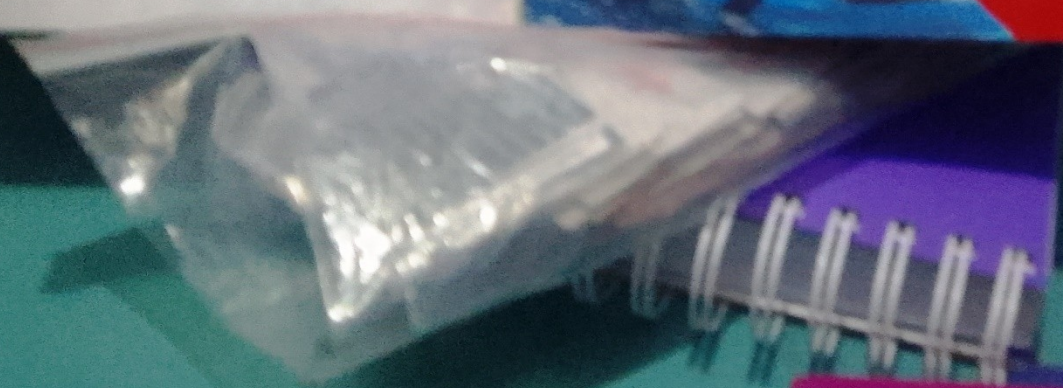
OCEANS

Robert Quinn

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CIL
Content
and Language
Integrated Learning

StandFor
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**Biggles Breaks
the Silence**



1 Match the oceans with the numbers (1-5) on the map.

- a. Arctic Ocean 4
- b. Atlantic Ocean 2
- c. Indian Ocean 5
- d. Pacific Ocean 1
- e. Southern Ocean 3

2 Answer the questions about the map.

1. Which ocean is between Africa and the Americas?

Atlantic Ocean

2. Which two oceans are probably the coldest?

Arctic Ocean and Southern Ocean

3. Which ocean is to the south of the Asian continent?

Indian Ocean

4. Which ocean looks bigger – the Pacific or the Atlantic?

Pacific Ocean

5. Which continent only borders on two oceans?

Europe

Earth's Oceans

From space, Earth looks very blue because there is a lot of water on its surface. There are five oceans that cover about 70% of the planet. They are the Pacific Ocean, the Atlantic Ocean, the Indian Ocean, the Arctic Ocean, and the Southern Ocean. These oceans hold about 97% of Earth's water, but it is salt water so we cannot drink it. The other 3% of Earth's water is fresh water. It isn't salty so people can drink it. We find fresh water in lakes, in rivers, and under the Earth's surface.

The Pacific Ocean is the largest ocean in the world. It covers 155.5 million km². That is about five times bigger than the continent of Africa. The northern part of the Pacific Ocean is between Asia and North America. The southern part of the Pacific Ocean is between Australia and South America.

The second largest ocean in the world is the Atlantic Ocean. It covers 76.8 million km². That is about four times bigger than the continent of South America. The Atlantic Ocean is between North and South America in the west, and Africa and Europe in the east.



Earth is our planet

The Indian Ocean is the third largest ocean in the world. It is south of Asia, between the continents of Africa and Australia. The Indian Ocean covers 68.6 million km². That is about four times bigger than Russia.

The world's next largest ocean is the Southern Ocean, around the continent of Antarctica. The Southern Ocean covers 20.3 million km². That is about twice as big as Europe.

Finally, the Arctic Ocean is the smallest ocean in the world. It covers 14.1 million km² around the North Pole. That is about seven times bigger than the island of Greenland.

How much of Earth's surface do the five oceans cover?

Oceans	%
Pacific	30.5%
Atlantic	15.1%
Indian	13.5%
Southern	4.0%
Arctic	2.8%

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In some places, oceans are very shallow. We can see the bottom easily when we go swimming or diving. The ocean is often shallow near the coast of a continent. This area is called the continental shelf.

In tropical oceans, we often find coral reefs in shallow water. In these areas, the water is warm and lots of sunlight shines through the water to the ocean floor. As a result, many plants and animals can live in these areas.

In other places, the ocean is very deep. For example, in the middle of the Pacific, the ocean floor is thousands of meters under the water. At the bottom, there is no sunlight and it is very cold, so plants cannot grow there.



The deepest underwater place in the world is Challenger Deep. It is in the Pacific Ocean, about 11,000 meters under the water. Challenger Deep is at the bottom of a very deep place called the Mariana Trench.

In 1960, two scientists wanted to visit Challenger Deep. They used a special ship called a bathyscaphe. It took them four hours and forty-seven minutes to go down to the bottom of the trench. In 2012, the film director James Cameron visited Challenger Deep in a ship called *Deepsea Challenger*. Then he made a film about the trench.

There are also very big mountains under the ocean. The biggest is Mauna Kea, on the island of Hawaii. It is 10,000 meters tall, from the ocean floor to the top of the mountain. About 5,800 meters of the mountain are under water.

The world's longest mountain range is under water, too. It's called the Mid-Atlantic Ridge and it's about 16,000 kilometers long. This mountain range goes down the middle of the Atlantic, from the Arctic Ocean to the Southern Ocean.



Oceans and Weather

Chapter

2



Oceans are important to weather around the world. For example, oceans can affect temperature, rain, and winds.

During the day, the sun shines on the oceans. The water becomes warmer, especially in the shallow areas near continents. In deeper areas, only water near the surface gets warm, but water near the bottom stays cold. At night, the surface of the ocean gets colder when the heat goes up into the air. These changes in temperature affect the weather on land, especially near the coast.

The areas near Earth's Equator are called the Tropics. They get more sunlight all year, so the ocean is warmer there. The areas near the North Pole and the South Pole are called polar zones. They are far from the Equator,

so they don't get as much sunlight. Because of this, ocean water is much colder in the polar zones.

Differences in temperature can move the water in the ocean and make currents. Warm ocean currents usually move from the tropical zones toward the North Pole or the South Pole. Cold ocean currents usually move from the polar zones toward the Equator. Strong winds can also make ocean currents.



Warm Currents

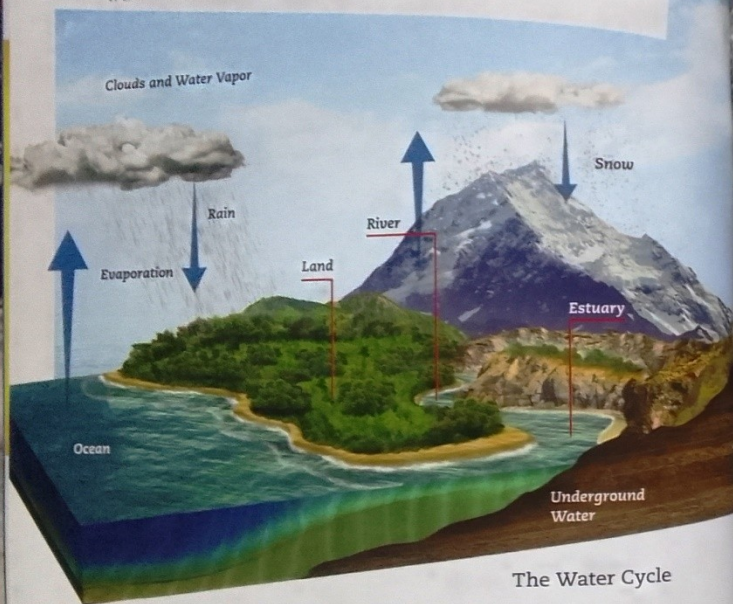
Cool Currents

Ocean currents

Some ocean currents can affect the weather far from the coast. For example, the Gulf Stream is a very strong current in the Atlantic Ocean. It takes warm water from the Gulf of Mexico to the Arctic Ocean. The Gulf Stream has a very important effect on Western Europe. It makes the weather warmer there, especially during the winter.

In the South Atlantic, there is an ocean current called the Brazil Current. It takes warm water south, along the eastern coast of Brazil, and on to Argentina. There is also a North Brazil Current along the northeast coast of Brazil. It takes warm water from the Equator towards the Caribbean Sea.

Oceans also affect weather because they are part of the water cycle. When ocean water is warm, it evaporates. This means water vapor goes into the air and makes clouds. When the air gets colder, the vapor makes drops of water. The largest drops fall down as rain or snow.



The Water Cycle

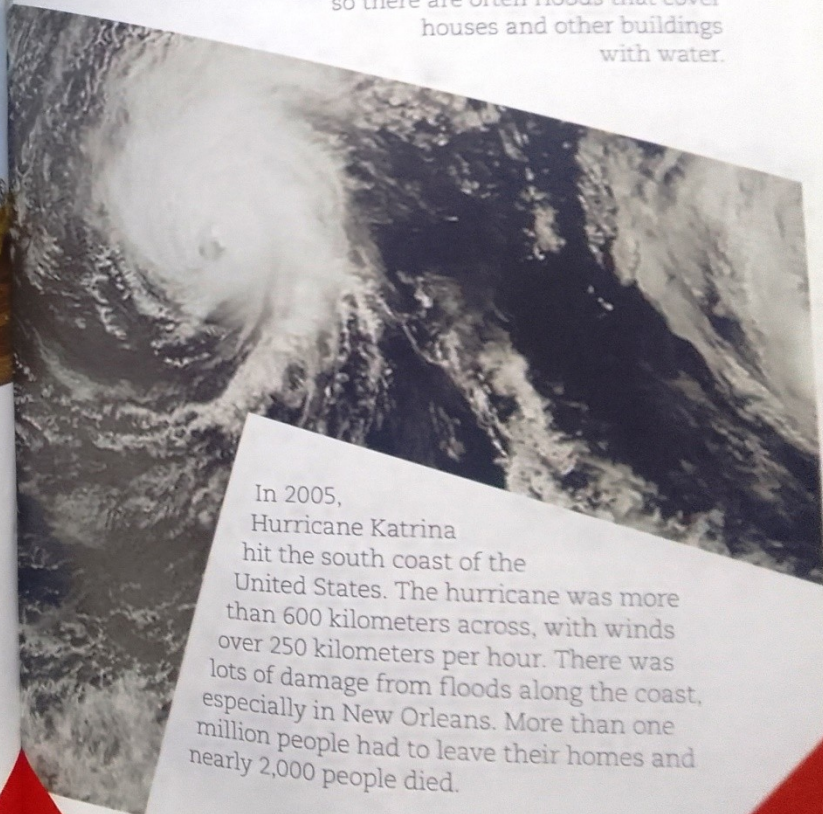
Around the world, most rain falls back into the ocean, but some falls on land, too. When that happens, some of the water goes into lakes and under the ground. Some of the water goes into rivers and then back to the ocean.

Every year, there are many storms over the oceans. The biggest storms are called hurricanes, but they have other names in some places. In Southeast Asia, hurricanes are called typhoons, while people in India call them tropical cyclones.

3

Hurricanes usually start over warm water in tropical areas. Winds come from many places and the air turns in circles. Warm water vapor goes high into the air and makes clouds. In the center of the hurricane, there is a place without any wind or rain. It's called the eye of the hurricane.

Hurricane winds are very fast – between 120 and 240 kilometers per hour. When hurricanes come to land, they can cause lots of damage to trees, roads, houses, and other buildings. Hurricanes also bring lots of rain, so there are often floods that cover houses and other buildings with water.



In 2005, Hurricane Katrina hit the south coast of the United States. The hurricane was more than 600 kilometers across, with winds over 250 kilometers per hour. There was lots of damage from floods along the coast, especially in New Orleans. More than one million people had to leave their homes and nearly 2,000 people died.

Waves and Tides

When winds move over the ocean, they push the water and make waves on the surface, at the top of the water. Light winds make very small waves, called ripples. These small waves are only a few centimeters high and they go away when the wind stops.

Strong winds make large waves on the ocean. These waves can become very big when the wind blows for a long time. During hurricanes, the largest waves can be more than 25 meters high.

Large waves do not go away when the wind stops. These waves are called swells, and they get smaller after a long time, or stop when they come to land. When swells come to shallow water, they get higher and closer together. The water at the bottom slows down quickly. At the same time, the water at the top keeps moving. Finally, the top of the wave falls and breaks on the land.

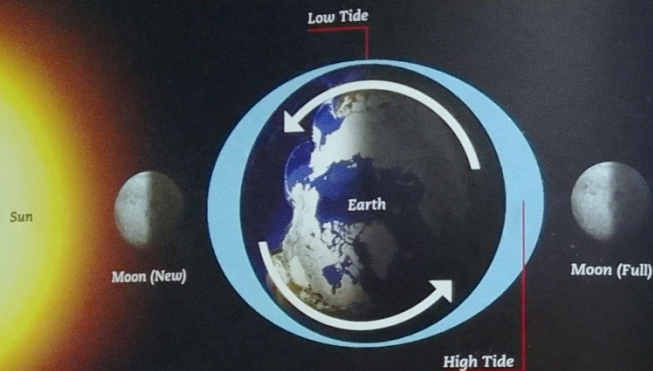
Sometimes there are very big waves, called tsunamis. Winds don't start tsunamis. They happen when there is an earthquake under the ocean. The earthquake pushes a lot of water and makes a very big wave that travels through the ocean. In deep water, tsunamis can travel at 800 kilometers per hour. That is faster than most airplanes.

Waves in shallow water



When a tsunami comes to shallow water, it slows down very quickly and becomes much higher. When the wave finally breaks on the land, it causes lots of damage. In 2004, there was a big tsunami in the Indian Ocean. Thousands of people died and millions of people lost their homes.

When you are at the beach, you can see how the ocean gets higher and lower at different times of day. At high tide, the water goes up to its highest point, and at low tide it goes back down to its lowest point. This happens because of the Moon and its gravity.



At high tide, the ocean level goes up on two sides of the planet. On one side, the ocean goes up because the Moon's gravity pulls the water away from Earth. On the other side, the ocean goes up because the Earth turns very quickly. At the same time, there are low tides on the other two sides of the planet. In most places around the world, there are two high tides and two low tides every day.

The Sun's gravity also affects the tides. When the Sun, the Moon, and Earth are in a line their gravities add together and the high tide becomes very high. These are called spring tides and they happen every two weeks, when there is a new Moon, and when there is a full Moon.

Seagrass, Seaweed, and Algae

When people go swimming under the ocean, they often find seagrass and seaweed. These two things look similar, but they are very different. Do you know the differences between them?

Seagrass is an underwater plant that has very long, thin leaves. Seagrass has roots that hold it on the ocean floor. It can also have flowers, like the plants on land. Seagrass needs sunlight to live, so it only grows in shallow water, near continents and islands.

Seagrass on the ocean floor



In some places, there is seagrass on large areas of the ocean floor. It often looks like an underwater garden. Many small fish and other animals live in seagrass. It gives them food and a place to hide from other animals. There are more than 50 types of seagrass in the world. The longest grows near Japan. Its leaves can be about three meters long.

A kelp forest

Kelp is a type of seaweed that we usually find in cool or cold water. Kelp often grows in large forests, and some types grow very quickly – more than 50 centimeters in one day. The longest kelp in the world is giant kelp. It can be more than 65 meters long.

Diatoms are another type of algae, but they are very small, so we need a microscope to study them. There can be thousands of diatoms in only one liter of water. They are also unicellular, which means each diatom is one living cell.

There are more than 100,000 types of diatom in the world, and they have many interesting shapes.

Seaweed also grows in the ocean, but it isn't a plant. It's an algae. Seaweed doesn't have leaves, like seagrass. The parts that look like leaves are called blades. Seaweed usually grows on rocks in shallow water, near land. It grows up to the surface of the water, where there is more sunlight.

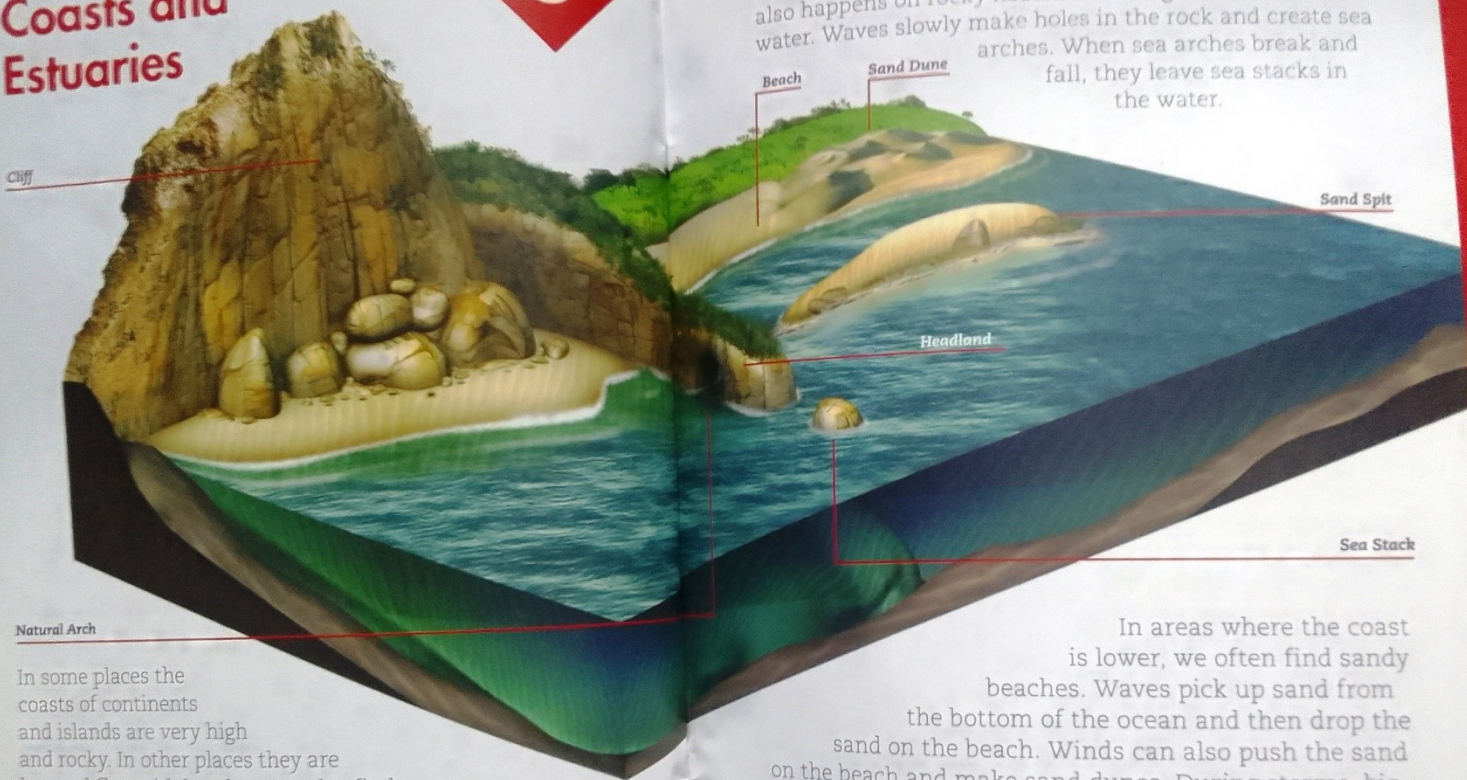
Diatoms are necessary for life in the oceans and on land. Many fish and other animals eat diatoms for food. Diatoms are also very important because they make oxygen – the gas that animals and people need to live. About 25% of our oxygen comes from diatoms.

Diatom shapes under a microscope

Coasts and Estuaries

Chapter 5

Over a long time, winds and waves can erode cliffs. That means they break off many small pieces of rock. This also happens on rocky headlands that go out into the water. Waves slowly make holes in the rock and create sea arches. When sea arches break and fall, they leave sea stacks in the water.



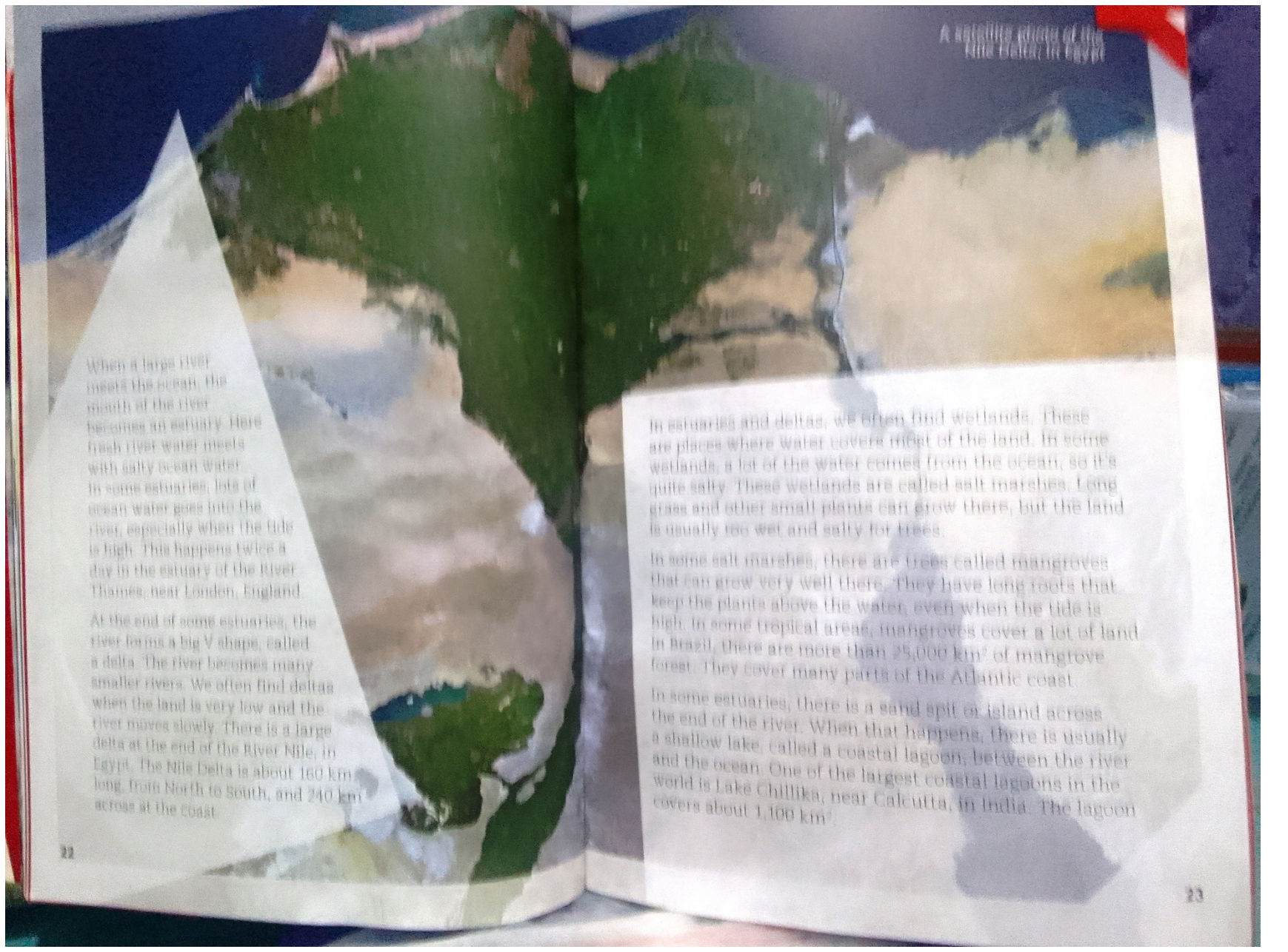
Natural Arch

In some places the coasts of continents and islands are very high and rocky. In other places they are low and flat, with beaches. We also find interesting areas where large rivers meet the ocean. These areas are called estuaries.

When coasts are high, we often find big cliffs, like the Cliffs of Moher in western Ireland. The Cliffs of Moher are about eight kilometers long and their highest point is more than 200 meters above the water. About one million people visit the Cliffs of Moher every year.

In areas where the coast is lower, we often find sandy beaches. Waves pick up sand from the bottom of the ocean and then drop the sand on the beach. Winds can also push the sand on the beach and make sand dunes. During storms, big waves can damage beaches because they pull sand and small rocks back into the ocean.

Sometimes waves drop lots of sand in the water near coasts. This sand can make a sand bar under the water or it can make a long area of dry land called a sand spit. There is a very big sand spit on the South Island of New Zealand, called Farewell Spit. It is more than 26 kilometers long.



When a large river meets the ocean, the mouth of the river becomes an estuary. Here fresh river water meets with salty ocean water. In some estuaries, lots of ocean water goes into the river, especially when the tide is high. This happens twice a day in the estuary of the River Thames, near London, England.

At the end of some estuaries, the river forms a big V shape, called a delta. The river becomes many smaller rivers. We often find deltas when the land is very low and the river moves slowly. There is a large delta at the end of the River Nile, in Egypt. The Nile Delta is about 160 km long, from North to South, and 240 km across at the coast.

In estuaries and deltas, we often find wetlands. These are places where water covers most of the land. In some wetlands, a lot of the water comes from the ocean, so it's quite salty. These wetlands are called salt marshes. Long grass and other small plants can grow there, but the land is usually too wet and salty for trees.

In some salt marshes, there are trees called mangroves that can grow very well there. They have long roots that keep the plants above the water, even when the tide is high. In some tropical areas, mangroves cover a lot of land. In Brazil, there are more than 25,000 km² of mangrove forest. They cover many parts of the Atlantic coast.

In some estuaries, there is a sand spit or island across the end of the river. When that happens, there is usually a shallow lake, called a coastal lagoon, between the river and the ocean. One of the largest coastal lagoons in the world is Lake Chilika, near Calcutta, in India. The lagoon covers about 1,100 km².

Marine Vertebrates

Chapter 6

Earth's oceans are home to billions of marine animals. These are animals that live in the ocean. Some marine animals, like fish, can only live underwater. Other animals, such as sea turtles, spend some time in the water and some time on land.

Some marine animals are vertebrates. This means they have a backbone inside their body. There are five types of vertebrate: fish, mammals, birds, reptiles, and amphibians.

A sea turtle and tang fish



Fish are marine vertebrates and they live in many different places. Coastal fish, such as sardines, live in shallow water near continents and islands. Sardines are very small, but they move together in very large groups, called schools. They also hide from larger fish in seagrass and kelp.

Reef fish live near coral reefs, where the water is shallow and there is lots of sunlight. Some reef fish, such as yellow tangs and clown fish, have very bright colors. Many reef fish are small, so they can turn quickly and hide in small places. There are about 4,000 types of reef fish in the world.

Oceanic fish spend most of their lives in open water, far from land. Small fish live near the ocean surface, where there is sunlight and lots of algae to eat. Larger fish, such as tuna, eat the smaller fish. Another large oceanic fish is the ocean sunfish. It can weigh more than 2,000 kilograms.

Deep sea fish live a long way under the surface of the ocean, where the water is dark and very cold. Many deep sea fish cannot see well, so they use smell to find food. Some deep sea fish, like lanternfish, go up to the surface of the water at night to look for food.

Fish are vertebrates because they have a backbone



Some marine mammals, such as whales and dolphins, spend all their lives in the water. Whales and dolphins need air to live, so they must hold their breath under the water, like people. Dolphins can stay under the water for ten or fifteen minutes, and some whales can hold their breath for two hours.

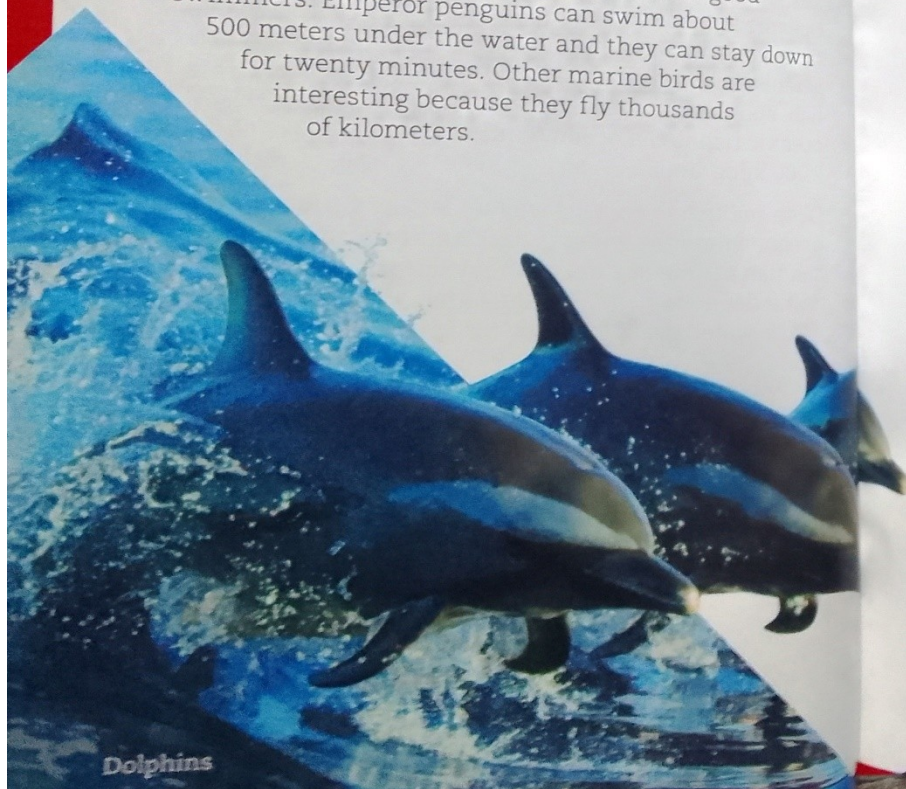
Seals are marine mammals that spend a lot of time in the ocean, but they often leave the water to sleep. Mother seals also have their babies on land. Many seals can live in cold areas, such as the Arctic and the Southern Ocean, but we also find them in warmer water.

Many marine birds eat fish, so they need to be good swimmers. Emperor penguins can swim about 500 meters under the water and they can stay down for twenty minutes. Other marine birds are interesting because they fly thousands of kilometers.

For example, some Arctic terns fly more than 90,000 kilometers every year.

Sea turtles are marine reptiles. They live in the water, but they also need air, like mammals. Some sea turtles can hold their breath under the water for seven hours while they are sleeping. Female sea turtles sometimes go onto land, but only to leave their eggs on beaches.

Sea snakes are reptiles that usually live in coral reefs, and there are about sixty types. Sea snakes need air, but they spend all their time in the water. Mother sea snakes have their babies in the water, too. Many sea snakes are poisonous, so they can be dangerous for people in the water. There aren't any amphibians that live in the ocean. Some can swim in salt water for a short time, but they can't live there.



Dolphins



Seals

Marine Invertebrates

Invertebrates don't have a backbone. Many of them have soft bodies and some have a shell for protection. There are six main groups of marine invertebrates. They are sponges, cnidarians, echinoderms, worms, mollusks, and crustaceans.



Sponges are very simple animals, and they don't have a head or body parts. Sponges can't move around, so they eat small living things that float in the water, like algae. Some sponges are very small, but the largest is the giant barrel sponge, and this can be more than two meters high.

Cnidarians are simple animals, like sponges, but they have some special body parts, like a mouth with many tentacles around it. The tentacles are poisonous, so cnidarians can use them to catch fish.

Corals and anemones cannot move around. They spend their lives in one place. Corals usually live in coral reefs, in large groups called colonies. Anemones usually live on rocks in shallow water near the coast. Jellyfish are different because they can float or swim from one place to another.

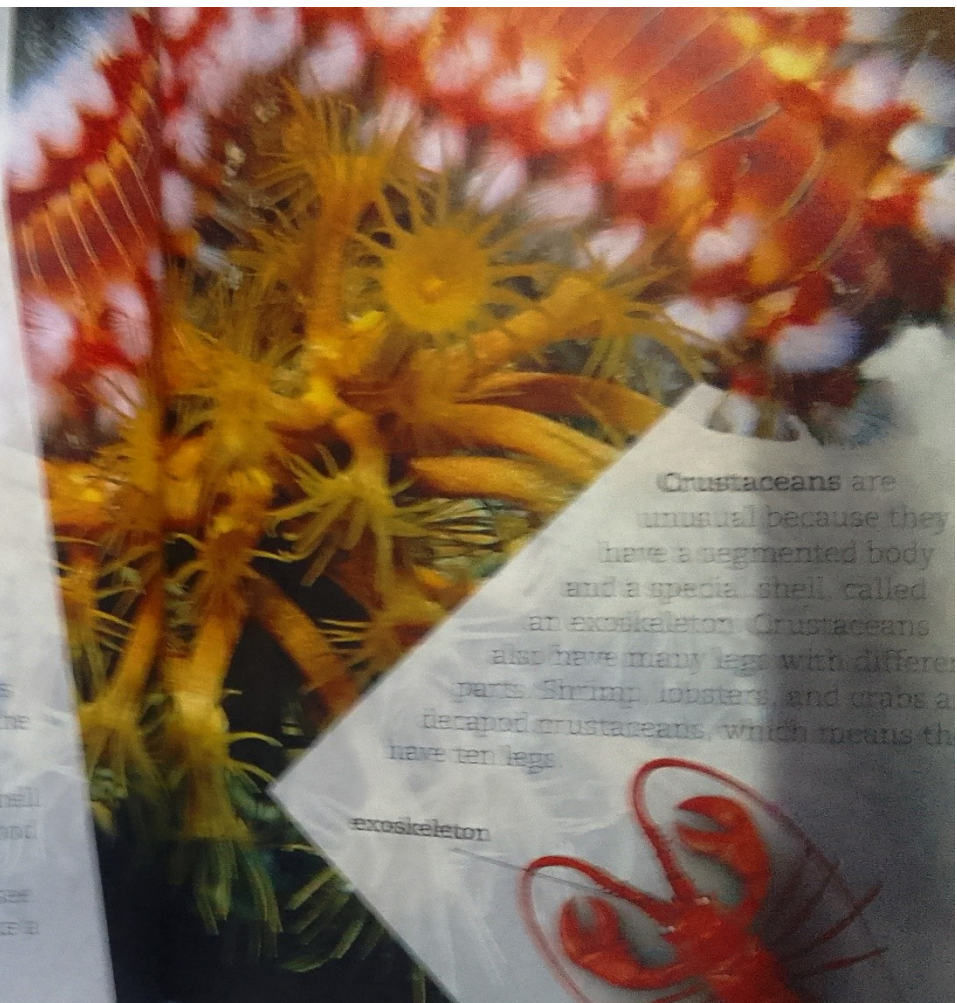
Echinoderms have bodies with five equal parts, so they often look like stars or flowers. On the bottom of their bodies, echinoderms have many small, thin feet. Echinoderms use these feet to hold things and pull their bodies around on the ocean floor. Sea urchins also have many long spines for protection.

Sea stars are carnivores, which means they eat other animals. Sea stars often eat other invertebrates, like sponges, corals, and mollusks. Sea urchins are different because they aren't usually carnivores. They're herbivores, so they eat seagrass, seaweed, diatoms, and other types of algae.

Crustaceans are a group of animals that live in the water. They have a hard shell called an exoskeleton. They have many legs and antennae. Some crustaceans are small, like copepods, and some are large, like crabs and lobsters. They are found in all parts of the world, from the deep ocean to the shallowest waters.

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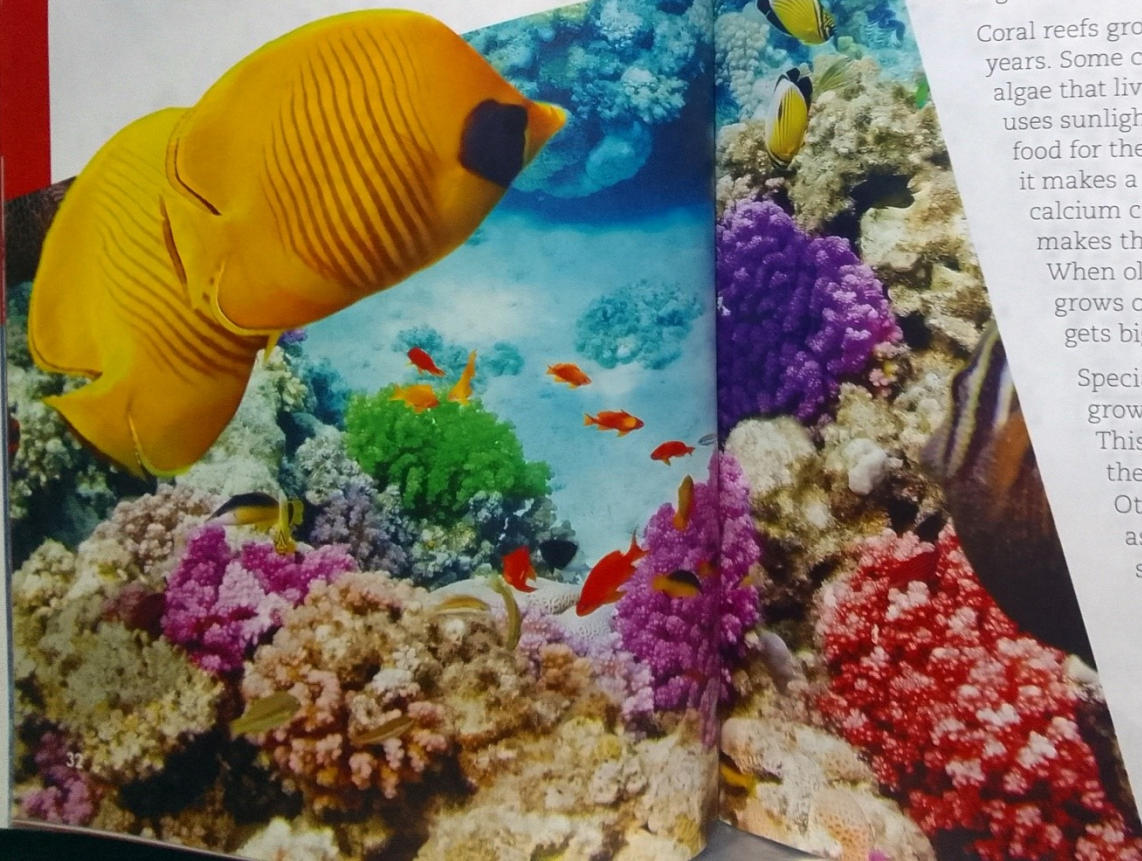
Crustaceans are unusual because they have a segmented body and a special shell, called an exoskeleton. Crustaceans also have many legs with different parts. Shrimp, lobsters, and crabs are decapod crustaceans, which means they have ten legs.

exoskeleton



Coral Reefs

Coral reefs are home to many things, from simple algae and coral to bigger animals like crustaceans, and fish. About 90% of all the world's coral reefs are in the Pacific Ocean, the Indian Ocean, and the Red Sea. The other 10% are in the Caribbean Sea and other warm parts of the Atlantic Ocean.



Coral reefs are large colonies of coral. We usually find them in shallow water where there is lots of sunlight all year. Coral also grows best when the water temperature is between 20 °C and 28 °C, so we don't find coral reefs in polar oceans.

Coral reefs usually grow near continents or islands. Sometimes there are shallow lagoons between the coast and the reef. Many small animals live in these lagoons because there is lots of algae for them to eat. The reef also keeps them safe from big waves and large animals that live in deep water.

Coral reefs grow very slowly over many years. Some corals have a special red algae that lives inside them. The algae uses sunlight to grow and it makes food for the coral. As coral grows, it makes a white mineral, called calcium carbonate. This mineral makes the coral hard, like rock. When old coral dies, new coral grows on top, and the reef slowly gets bigger and bigger.

Special types of green algae grow between pieces of coral. This algae gets hard and holds the pieces of coral together. Other marine animals, such as sponges, oysters, and snails, also live in coral reefs. When these animals die, the hard parts of their bodies become part of the coral reef.

In some places, coral make islands, called atolls, with a lagoon in the center. Atolls are made when a reef grows on an underwater mountain. After a long time, the mountain goes under the water, but the coral keeps growing at the top.

In the Indian Ocean, there is a country called the Republic of Maldives which is a group of twenty-six atolls. Most of them are only one or two meters above the water. Because of this, there are often floods during storms. The Maldives are also in danger because the ocean will get higher in the future. If the water gets too high, it could cover all the islands.

The world's largest coral reef is the Great Barrier Reef, near Australia. It's about 2,600 km long and it covers 344,400 km². That's about as big as Germany. Most of the reef is part of the Great Barrier Reef Marine Park, which protects the reef. The Park also controls what people can do there, such as fishing and water sports.

The Great Barrier Reef needs protection from many dangers. For example, fishing boats sometimes hit the reef and break off large pieces of coral. Some visitors also damage the reef when they take pieces of coral home with them. It takes many years for the coral to grow back again.

Pollution is also a problem for reefs because it makes the water dirty and unhealthy. When coral isn't healthy, it loses its color and becomes white. This is called bleaching. Changes in how deep the ocean is also damage coral reefs. If the ocean becomes too deep, the algae inside the coral can't get enough sunlight to make food.

Polar Oceans

Earth has two polar oceans – the Arctic Ocean and the Southern Ocean. They are cold and icy, especially in the winter, but in some ways these two oceans are very different.

The Arctic Ocean is Earth's smallest and shallowest ocean. It is usually about 1,000 meters deep. There is land all around the Arctic Ocean and it gets lots of fresh water from large rivers. We also see many icebergs. Icebergs are very large pieces of ice that float in the water. Icebergs can travel across the ocean for many kilometers before they finally melt and turn back into water.

In the winter, ice covers about 80% of the Arctic Ocean, and in some places, the ice is more than 50 meters deep. In the summer, ice only covers about 60% of the Arctic Ocean, and it becomes much thinner.

In the past, there was more ice all year, but the Arctic is getting warmer and more ice is melting.

Narwhals in
the Arctic
Ocean

Under the Arctic ice, there aren't many plants, but there is lots of algae for small fish and other marine animals to eat. About 60 types of bird also live in the Arctic or spend time there during part of the year. Many Arctic birds are white or grey, so they can hide easily in the snow. Some examples are Arctic terns and snowy owls.

Some marine mammals live in the Arctic Ocean, such as dolphins and whales. The most unusual whale is the narwhal, which has a long, hard tusk on its head. Beluga whales are unusual because they are white all over. We also find polar bears in the Arctic, but they only spend part of their time in the water.



The Southern Ocean is much larger and deeper than the Arctic. The Southern Ocean doesn't have much land around it, and the water is more than 4,000 meters deep in most places. The continent of Antarctica is in the center of the Southern Ocean. It's the coldest continent in the world.

Antarctica has about 90% of the world's ice and in some places it can be very deep. In fact, the deepest ice in the world is in Wilkes Land, in eastern Antarctica. The ice there is more than 4,770 meters deep. Scientists can also find very old ice in

Antarctica. In some places, it's more than one million years old.

In the Southern Ocean, there aren't many underwater plants because the water is very deep and very cold. There are lots of diatoms and other algae in the water. There are also many krill, which are very small crustaceans that look like shrimp. Many marine animals, like whales and seals, need krill for food.

The Southern Ocean is home to many marine birds, such as penguins. These black and white birds cannot fly, but they can go under the water to catch krill, fish, and other food. Penguins spend a lot of time in the water, but they sleep, and have their babies on land. Emperor penguins are the largest penguins. They can be 130 cm tall and more than 40 kilograms.

An ice shelf in
Antarctica

There are large ice shelves along the coast of Antarctica. Sometimes large pieces of ice break off and become icebergs. In 2000, one of the largest icebergs in history broke off the Ross Ice Shelf in Antarctica. The iceberg was about 240 kilometers long and 40 kilometers across. It was bigger than the island of Puerto Rico.

Food from the Ocean

Chapter 10

People all around the world get food from the ocean. Every year, fishing boats catch about 80 million tonnes of seafood. About 84% of that seafood is fish and the rest is mollusks, crustaceans, and other marine animals. In some countries, people also eat seaweed and other types of algae.

Fishing boats catch fish with big nets or long fishing lines that they pull through the water behind them. In these ways, fishermen can catch small fish, such as anchovies, and larger fish, like cod and tuna. Nets are better for catching small fish that travel in big schools.

Fishing boats sometimes catch marine animals that they don't want. This is a problem called bycatch. For example, fishing nets sometimes catch dolphins and sea turtles. These animals need air, so they usually die before they can get out of the nets. Fishing lines also catch many marine birds.

Most fishing happens along coasts and near continental shelves. Smaller fishing boats usually go back to land every day so they can sell their fish at markets. Larger fishing boats can stay away for a longer time before they go back to land. These big boats carry lots of ice and have big refrigerators to keep the fish cold until they get back to land.



In many parts of the world, overfishing is a big problem. Sometimes fishermen catch too many fish in one place, and sometimes they catch fish that are too young and small. Because of this, some countries stop too many boats from fishing near their coasts. They also watch how much fish those boats catch.

Fishing boats can use nets to catch many small crustaceans, such as shrimp. In fact, every year, people around the world catch more than three million tonnes of shrimp. China is the country that catches the most – about 40% of the world's total. Indonesia, India, Canada, and the United States also catch a lot of shrimp every year.

To catch larger crustaceans, like crabs and lobsters, fishermen use nets or they leave special traps in the water, with some food inside. The crustaceans go into the traps to eat the food, and then they cannot get out again. Fishermen can also use traps to catch mollusks, such as octopuses and squid.

An offshore fish farm



In many parts of the world, people keep fish on fish farms. This is called aquaculture. Sometimes the fish live outside in lakes. Sometimes they live inside buildings, in large tanks of water. There are also many offshore fish farms, where the fish live in the ocean, but they stay in large closed areas. On fish farms, the fish get lots of food every day, so they grow very quickly. Some farms keep other marine animals, too, such as crustaceans and mollusks.

In some countries, seaweed is an important food and there are many farms that grow special types of seaweed for people to eat. Kombu and nori are the most usual types. In Japan, China, Korea, and other Asian countries, many people make dishes with kombu and nori because they are very healthy. In Japan, people use lot of nori to make sushi and other Japanese dishes.



Lobster traps


Oceans and Energy

Chapter

11

We need energy for many things every day. For example, we use energy from gasoline in our cars, and we use electricity in our homes and other buildings. Some of this energy comes from oil and natural gas that we find under the ocean floor. With modern technology, we can also get lots of clean energy from ocean winds, waves, and tides.

About 30% of all the oil and natural gas that we use comes from under the ocean floor. We use lots of oil to make gasoline, plastic, and other things. We often use natural gas to heat water, cook our food, and keep our homes warm in winter. We can also use oil and natural gas to make electricity.



When we find lots of oil or natural gas under the ocean floor, we build offshore platforms. From these platforms, workers make a very deep hole in the ocean floor. After that, they can bring the oil or natural gas up to the surface of the ocean. Here large boats called tankers take it to land.

Some offshore platforms are on very long legs that stand on the ocean floor. We cannot move these platforms easily from one place to another. Other platforms don't stand on legs. They float on the water, like large boats. These platforms can move around easily and they are also much cheaper to build.



An offshore platform and a tanker

When offshore platforms are near the coast, people often build long underwater pipes, called pipelines, to send the oil and gas to land. Underwater pipelines are better than tankers because waves and bad weather don't affect them. Tankers can also hit things in the water, such as rocks or other boats.

As well as oil and gas, we can get energy from ocean winds, waves, and tides. These types of energy are clean because they don't make any pollution. They are also renewable because we can use them again and again.

Offshore wind farms have many towers with turbines at the top. The turbines have long blades that turn in the wind and this makes electricity. Then underwater cables carry the electricity to the land. One of the largest wind farms in the world is the London Array, in the Thames Estuary in England. It has 175 turbine towers.

There are also turbines that use waves to make electricity. Some turbines use waves that break on the coast. Other turbines are in deep water, where they go up and down with the waves. One of the biggest wave parks in the world is near Porto, in Portugal, and there are plans for more wave parks in the future, in the U.K. and the U.S.

We also use ocean tides to make electricity. We can collect water at high tide and let it out at low tide. When the water is let out, it moves turbines and makes electricity. We can also build underwater turbines with long blades that turn when the tide goes up and down. There are plans for a new tide park in Scotland that could make electricity for 175,000 homes.

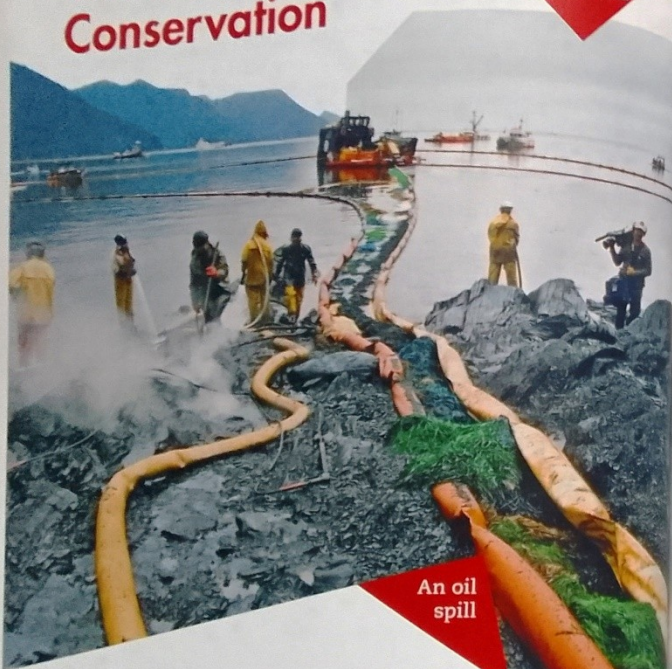
In the future, ocean currents, such as the Gulf Stream in the Atlantic Ocean, could also make a lot of electricity. We could build turbines under the ocean, or they could float in the ocean like boats.

Scientists at the University of Florida think the Gulf Stream could make enough electricity for millions of homes.

Wind turbines on offshore towers

Ocean Conservation

Chapter 12



An oil spill

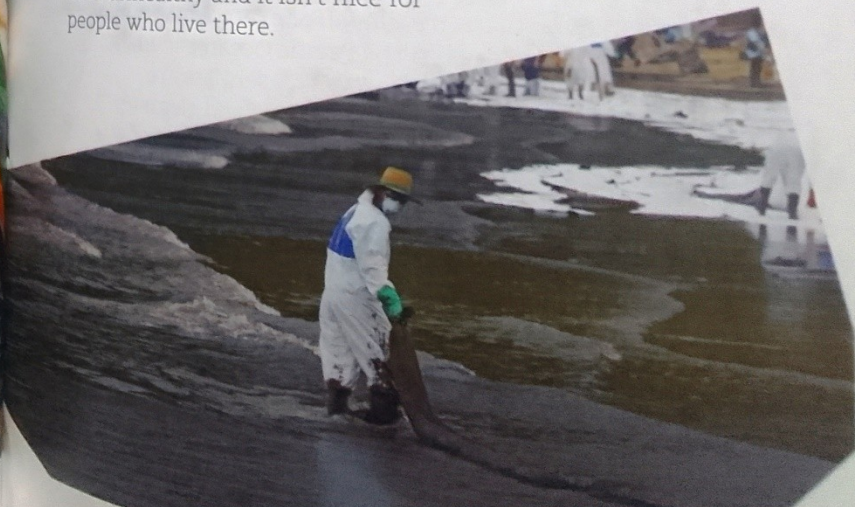
Healthy oceans are very important for all life on Earth, including plants, animals, and people. Because of that, we need to protect our oceans from many dangers. There are many scientists and conservation groups that work to protect our oceans, but they need our help.


Water pollution is a big problem for our world's oceans. When we pollute rivers, the pollution goes into estuaries and then finally into the ocean.

This pollution kills many plants and animals and it can also make the water dirty and unhealthy for people. Pollution from offshore platforms and tankers can also damage the ocean. When there are oil spills, lots of oil gets into the water. One of the biggest oil spills was in 2010, in the Gulf of Mexico. Oil from a platform covered about 75,000 km² of the ocean, which is bigger than Ireland. In the future, oil companies must stop oil spills and help to protect our oceans.

Air pollution can also damage our oceans. When there is smoke and other pollution in the air, it meets with water vapor and then falls down as acid rain. This acid rain damages marine life, especially algae, coral, and mollusks. On land, acid rain damages trees and other plants, and it goes into lakes and rivers, too. It's a very big problem.

Solid waste is another type of pollution that affects our oceans. When people throw garbage into the water, it can go to the bottom and stay there for many years. In places where there are many people, such as beaches, we often find garbage in the water. This makes the area unhealthy and it isn't nice for people who live there.





Plastic garbage is a big problem. More than eight million tonnes of plastic go into the ocean every year. The plastic floats in the water and breaks into many smaller pieces. This garbage is very dangerous to fish and other marine animals when they eat it.

Ocean currents carry plastic around the world, and in some places there are tonnes of plastic waste in the water. For example, there is a large area in the Pacific Ocean called the Great Pacific Garbage Patch. Scientists are studying ways to collect this plastic and clean up our oceans, but it could take many years. For now, we must all use less plastic and recycle any plastic that we don't want.


There are also problems in the ocean because of climate change. Our climate is changing because Earth is getting warmer. When people burn oil, gasoline, and natural gas, it puts carbon dioxide into the air. Carbon dioxide stops the Sun's heat from leaving Earth, so the temperature goes up. This is called the Greenhouse Effect.

The Greenhouse Effect is making the ocean too. This change causes more storms and hurricanes and it also affects deep ocean currents, like the Gulf Stream. Because of this, the climate and weather will change in many places in the future.

With higher temperatures, polar ice is melting in the Arctic and Antarctica. When lots of polar ice becomes water, the oceans get higher. That can have an effect on low, coastal areas, such as beaches and marshes. If the ocean goes up too much, it could cover those areas. Many islands could also be under the water in the future.

Atmosphere

The Greenhouse Effect

- 
1. Sunlight heats the Earth and the atmosphere.
 2. Carbon dioxide and other gases in the atmosphere hold in the heat.
 3. The Earth's temperature goes up.

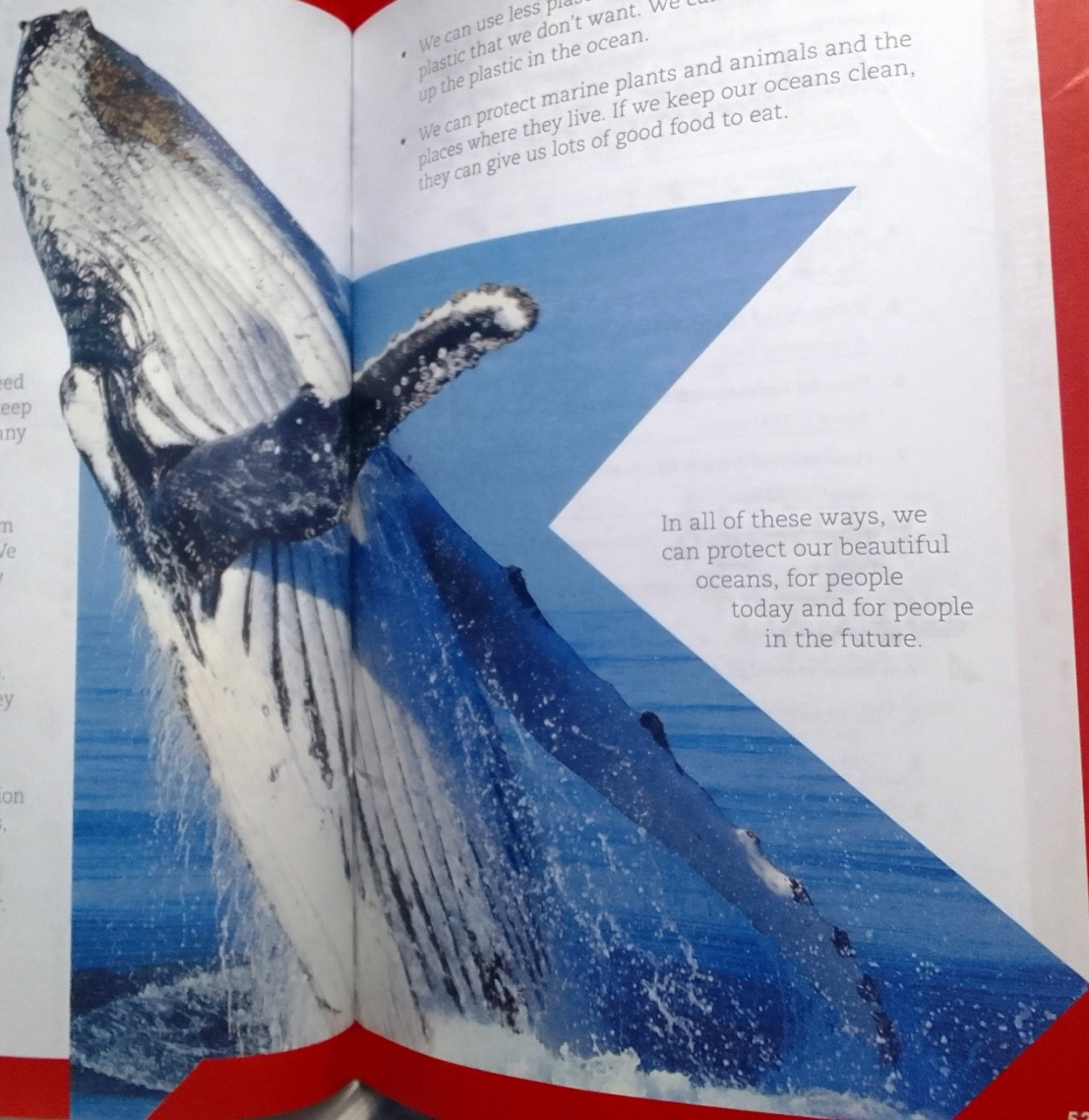
Warmer ocean water can damage coral reefs. If the temperature goes up too much, large areas of coral reef could become unhealthy and die. Some types of algae also grow too fast when the water is very warm. If there is too much algae in the water, it stops the sunlight and then marine plants cannot grow.

For all these reasons, we need to protect our oceans and keep them healthy. There are many things we can do.

- We can stop air pollution and use clean energy from wind, waves, and tides. We can also use clean energy from the sun.
- We can burn less oil, gasoline, and natural gas. They aren't clean and they put carbon dioxide into the air.
- We can stop water pollution and keep our lakes, rivers, and oceans clean. We mustn't put pollution and solid waste into the water.

- We can use less plastic and we can recycle any plastic that we don't want. We can also try to clean up the plastic in the ocean.
- We can protect marine plants and animals and the places where they live. If we keep our oceans clean, they can give us lots of good food to eat.

In all of these ways, we can protect our beautiful oceans, for people today and for people in the future.



Read pages 6 to 9.

1 Answer the questions.

- How much of Earth's surface do the oceans cover?
About 70%.
- What percentage of Earth's water is salt water?
About 97%.
- Which ocean is between Africa and Australia?
The Indian Ocean.
- Which ocean is the smallest?
The Arctic Ocean.
- What do we call a shallow area of ocean next to a continent?
A continental shelf.
- How far under the water is Challenger Deep?
About 11,000 meters.
- How much of Mauna Kea is under the ocean?
About 5,800 meters.
- Where is the longest mountain range on Earth?
Under the Atlantic Ocean.

Read pages 10 to 16.

1 Are these sentences true or false? Write T or F.

- The water at the surface of the ocean becomes cooler at night. ☐ T
- Cold currents move from the tropical zones to the polar zones. ☐ F
- When the water vapor in the air gets colder, it evaporates. ☐ F
- Ripples are big waves that keep moving when the wind stops. ☐ F
- In hurricanes, the largest waves can be over 100 meters high. ☐ F
- Tsunamis get much higher when they come to shallow water. ☐ T
- Earth's tides depend on the gravity of the Sun and the Moon. ☐ T
- Spring tides are very high tides that only happen in spring. ☐ F

Read pages 17 to 23.

Complete the descriptions with words from the box.

delta diatom giant kelp headland seagrass seaweed wetland

- It looks like a plant but is an algae. seaweed
- It is a very small algae that can have many different shapes. diatom
- It is an underwater plant that has leaves, roots and flowers. seagrass
- It is a special type of algae that can be 65 meters long. giant kelp
- It is a low, flat area where water covers most of the land. wetland
- It is a high, rocky coastal area that goes out into the water. headland
- It is a V-shape that forms where some rivers meet the ocean. delta

Read pages 24 to 31.

1 Match the beginnings and endings of these sentences.

- | | |
|---|---|
| 1. A vertebrate is an animal... | a. but they spend their lives in the water. |
| 2. Sardines are coastal fish... | b. that don't have a head or body parts. |
| 3. Whales and dolphins look like fish,... | c. that move in groups called schools. |
| 4. Sea turtles and snakes need air... | d. but they are marine mammals. |
| 5. Sponges are simple animals... | e. that has a backbone inside its body. |
| 6. Echinoderms are invertebrates... | f. that often look like stars or flowers. |

Read pages 32 to 39.



Check the best answers.

- Coral grows best in water that...
 - is shallow and warm. ☒
 - is warm and deep. ☐
 - is shallow and cold. ☐
- Calcium carbonate is a white mineral that...
 - makes food for coral. ☐
 - makes coral hard. ☒
 - makes coral bigger. ☐
- Atolls are islands that sometimes form...
 - in the Indian Ocean. ☐
 - in polar oceans. ☐
 - on underwater mountains. ☒
- The Great Barrier Reef is about the same size as...
 - Australia. ☐
 - Germany. ☒
 - The Maldives. ☐
- The Arctic Ocean is... than the Southern Ocean.
 - smaller and shallower. ☒
 - larger and deeper. ☐
 - deeper and colder. ☐
- The Ross Ice Shelf is...
 - 240 km long. ☐
 - on the coast of Antarctica. ☒
 - 4,770 meters deep. ☐
- Beluga whales are unusual because they...
 - have long tusks. ☐
 - eat dolphins. ☐
 - are all white. ☒
- Krill are an important food...
 - for whales. ☒
 - for polar bears. ☐
 - for snowy owls. ☐

Read pages 40 to 47.

Complete the sentences with words from the box.

- forms nets park pipelines platforms seafood traps turbines
- Fish is about 84% of all the seafood that we catch and eat.
 - Most fishing boats use large nets or long lines to catch fish.
 - Some fishermen leave traps with food inside to catch lobsters.
 - On some fish forms, the fish live in lakes or large tanks of water.
 - We can build offshore platforms to get oil from under the ocean.
 - Underwater pipelines can carry oil more safely than tankers.
 - Wind turbines have long blades that turn to make electricity.
 - They are building a large tide park in the ocean near Scotland.

Read pages 48 to 53.



Answer the questions. Suggested answers.

- Why should we help conservationists to protect the oceans?
Oceans are important to all life, including plants, animals, and people.
- How does acid rain affect the oceans?
Acid rain damages marine life, especially coral, algae, and mollusks.
- How much plastic do we put into the ocean every year?
We put more than eight million tonnes of plastic into the ocean every year.
- Why is there so much carbon dioxide in the air now?
We are burning a lot of oil, gasoline, and natural gas.
- How do higher temperatures make the oceans deeper?
When temperatures are higher, lots of polar ice melts and becomes water.
- What happens to coral when the water gets too warm?
The coral becomes unhealthy and it can die.

Are these sentences true or false? Write T or F.

- The areas near Earth's poles usually get more sunlight. ☐
- Strong winds and temperature changes can make currents. ☐
- There are more hurricanes in places where the ocean is cold. ☐
- When a hurricane comes to land, there are often floods. ☐
- When there is a big tsunami, it can cause earthquakes. ☐
- Seagrass grows where the water is shallow. ☐
- Seaweed and diatoms are different types of algae. ☐
- We need algae because it gives us lots of carbon dioxide. ☐

Read the sentences and circle the correct words.

- Waves can erode holes in rocky headlands and create sea arches / cliffs.
- Winds can create sand bars / dunes when they move the sand on beaches.
- In estuaries / wetlands, river water meets with salty water from the ocean.
- Coastal spits / lagoons are lakes that form at the end of some estuaries.
- Oceanic / Reef fish are often small, so they can hide easily in small places.
- Seals are mammals, so they can't / mus hold their breath under water.
- All crustaceans / worms have a special shell called an exoskeleton.

Answer the questions. Suggested answers.

- Which two oceans have the most coral reefs? Why?
The Pacific and Indian oceans have the most coral reefs.
The water is warmer there.
- Why do many marine animals live near coral reefs?
The reef protects them from waves and there is lots of algae to eat there.

3. Why are many Arctic birds and mammals white?
It is difficult to see white animals in the snow and ice, so they can hide more easily.

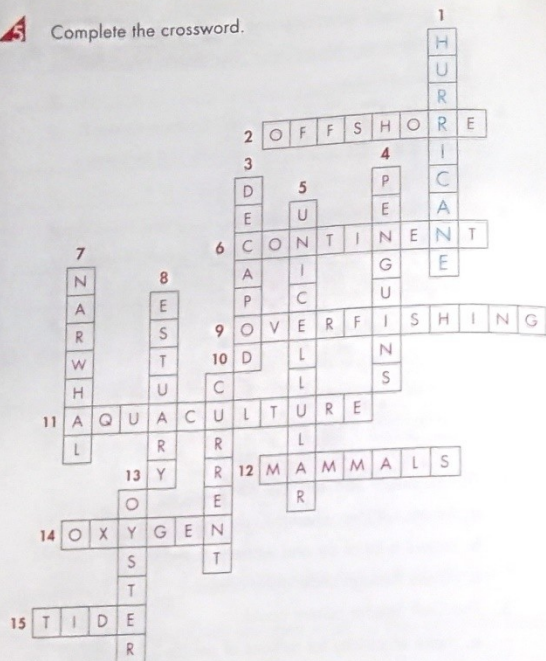
4. Why aren't there many plants in the Southern Ocean?
The Southern Ocean is very deep and dark, and the water is also very cold.

5. Which fishing boats can stay away for a long time? Why?
Bigger boats can stay away longer because they have large refrigerators.

Check the best answers.

- About 30% of our oil and gas...
 a. comes from clean energy. ☐
 b. comes from under the ocean floor. ☒
 c. is in large boats called tankers. ☐
- The electricity from offshore tide parks...
 a. moves turbines when the tide goes down. ☒
 b. makes a lot of air and water pollution. ☐
 c. travels through underwater cables. ☐
- The Gulf Stream current could...
 a. make electricity for millions of people. ☒
 b. float in the ocean like a big boat. ☐
 c. use the wind to make energy. ☐
- Some oil spills happen when...
 a. people throw waste into the water. ☐
 b. there are problems on offshore platforms. ☒
 c. water gets into tankers and pipelines. ☐
- The carbon dioxide that we put into the air...
 a. makes our oceans and planet too warm. ☒
 b. causes more hurricanes in polar zones. ☐
 c. can make coral reefs grow too fast. ☐

5 Complete the crossword.



Across

2. in the ocean, but near the coast
6. a very large area of land
9. when people catch too many fish
11. keeping fish on a farm
12. whales, dolphins, and seals
14. a gas that we need to live
15. when the ocean goes up and down

Down

1. a big, dangerous storm
3. any crustacean that has ten legs
4. black and white birds
5. with only one living cell
7. a whale that has a long tusk
8. where a big river meets the ocean
13. a mollusk that has a hard shell

- affect make something change
 algae very simple plants without leaves
 area a part of somewhere
 backbone the big bone that goes down the back of an animal
 breath the air that goes into a mammal's body
 bristle short, thick hair
 cable thick strong metal for carrying electricity
 cliff high rock with a very steep side
 climate the weather in a place
 coast the land beside the ocean
 conservation protecting the environment
 continent a large area of land
 cover go over something
 current the movement of water across an ocean
 damage break something
 earthquake when the ground moves
 energy something that can give power
 equal the same as
 erode make something smaller, little by little
 float stay on the surface of the water
 flood a lot of water covering an area
 garbage things that people throw away

gas like air; not solid or liquid

gravity this pulls things down towards the ground

grow get bigger

lake a large area of water

mammal an animal that has live babies

melt change from ice to water

microscope something that can make small things look larger

mineral a natural thing that we find on or under the ground

mountain a high place

net material with holes for catching fish

oil a thick liquid used as a fuel

pipeline a long metal or plastic thing that oil or gas can go through

planet a large round thing which goes around a star

plastic a light, often colored, material made from oil

poisonous can cause sickness or death

polar bear a large white mammal that lives in the Arctic

pollution making water, land, or air dirty

reptile an animal that has cold blood and lays eggs

root the part of a plant that is in the ground

sand very small pieces of rock

segment a part of something

shallow not deep

shell the hard outside part of some animals

shine the sun shines

snake a long, often dangerous, reptile with no legs

solid waste garbage that is hard, not liquid

spill flowing outside of a container or pipe

spine a sharp part on the outside of a plant or animal

storm very bad weather with strong winds

surface the top of something

tank a large thing that holds water

tide the rise and fall of the ocean every 12 hours

trap something for catching animals

turtle an animal with a shell that lives in the ocean

tusk a very long sharp tooth

vapor in the form of a gas

wave a high line of water that goes across an ocean

whale a very large mammal that lives in the ocean